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**Not all adverse health outcomes in former contact sports athletes are  
concussion related**

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Former National Football League (NFL) professional American footballers report considerably higher prevalence of physical and social impairment than neurobehavioral dysfunction.

There is continued interest in the association between exposure to traumatic brain injury (TBI) during contact sports participation and lifelong adverse health effects, including neurodegenerative disease, mental health disorders and suicide [1]. In part, this is driven by reporting of a neurodegenerative pathology linked to TBI, chronic traumatic encephalopathy (CTE), in autopsy series of former athletes from multiple contact sports [1]. However, while the number of cases with confirmed CTE neuropathologic change grows, understanding of late clinical outcomes in 'at risk' populations remains challenged by acknowledged methodological limitations in many studies to date [1,2]. In the paper by Brett et al on page XXX, the authors address some of these limitations in providing their observations on data gathered directly from former National Football League (NFL) professional American footballers [3]. In so doing, a picture of health emerges in these former contact sports athletes that more often is marked by physical and social symptoms than by neurobehavioral dysfunction.

In contrast to recent advances defining the neuropathology of CTE [4], there has been less progress in understanding its clinical presentation. In the earliest accounts of punch drunk boxers and through later case series describing dementia pugilistica, a pathology synonymous with CTE, the stereotypical clinical syndrome described was one of mainly motor and cognitive issues [1]. More recently, reporting of wider, non-boxer athletes (largely former American footballers) and others with autopsy confirmed CTE neuropathologic change has added to the range of possible clinical features

associated with CTE; one recent review listing over 50 putative signs and symptoms of the condition, including multiple neuropsychiatric symptoms and suicide [2]. In part, this rather non-specific clinical picture of CTE reflects recognised biases in studies based on research brain donations and reliance on largely retrospective clinical data gathered from next of kin interviews or case record reviews.

Brett and co-authors address some of these limitations by employing validated clinical questionnaires to gather data on self-reported symptoms directly from a sample of former NFL athletes. The authors then applied latent profile analysis to identify three distinct subgroups within their study population. Their results reveal an overwhelming majority of their cohort (~80%) within profiles defined by physical and social limitations, with the remainder reporting symptoms of neurobehavioral dysfunction. Intriguingly, only neurobehavioral dysfunction was associated with concussion history. Of note, however, those in the neurobehavioral dysfunction subgroup were also more likely to report a variety of medical and psychiatric conditions which, as the authors note, might confound interpretation of outcomes based on self-reporting.

There is clearly some way to go before we develop a complete picture of lifelong health outcomes in former contact sports athletes, but work such as this from Brett et al demonstrates a more nuanced picture than might typically be reported. Not all (or even a majority) of self-reported health concerns in former contact sports athletes are cognitive or neuropsychiatric, or even linked to concussion exposure.

## References:

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- 4 McKee, A, Cairns, NJ, Dickson, DW, et al. The first NINDS/NIBIB consensus meeting to define neuropathological criteria for the diagnosis of chronic traumatic encephalopathy. *Acta Neuropathol* 2016;131: 75-86